

### **The North Delta: Refugia for Native Fishes in the Upper San Francisco Estuary**

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**Abstract:** Biological communities within the upper San Francisco Estuary have drastically changed over the last decade, wherein pelagic species have declined and nearshore species have proliferated. Because biological invasions are one potential driver of change in the system, we set forth to systematically document the distribution and abundance of invasive fishes and macrophytes throughout the Sacramento-San Joaquin Delta. We conducted surveys throughout the Delta from 2008-2010, and then focused primarily on surveying the North Delta (Lindsey and Cache Sloughs, Liberty Island, and the Deepwater Ship Channel) from March to June 2011. We evaluated the relationship between community composition and environmental variables using constrained ordination techniques, and conducted spatial analyses of fish assemblages using Geographic Information Systems mapping software. Our findings indicate that the North Delta supports a unique and diverse community of fish taxa, including delta smelt and juvenile Chinook salmon, and therefore may serve as an important refugial habitat for native fishes.

**Statement of Relevance:** The San Francisco Estuary is a highly altered system inhabited by numerous successful invasive species. Our study demonstrates the importance of the North Delta for maintaining biodiversity, and highlights the utility of further ecological studies in the region for application elsewhere.